Utah Division of Air Quality

Air Pollution Modeling

-Working To Clean Utah's Winter Air

What Is An Air Pollution Model?

- A computer model simulates the meteorological conditions and chemical reactions that govern air pollution formation and transport.

Why Do We Need Air Pollution Models?

- Winter pollution is formed when gaseous emissions from cars, industry, and residential sources react in the air to form particulate pollution. Dust is not a large contributor.
- Utah's complex mountain-valley meteorology plays a large role in the build-up of particulate pollution.
- Without a model only simple broad brush emission strategies are possible and outcomes are less certain.

Image Credit: Time-Science.com

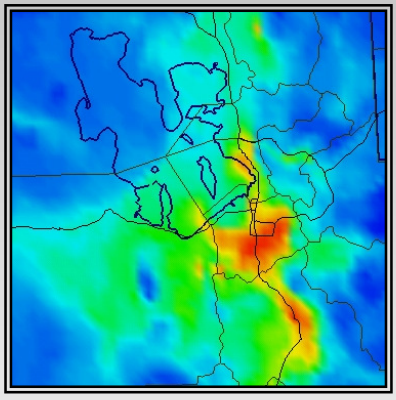
How Are Air Pollution Models Used?

- Test the effects of emission reductions on air pollution.
- Identify the most effective cost-benefit emission strategies.
- Provide quantitative basis for decision makers.

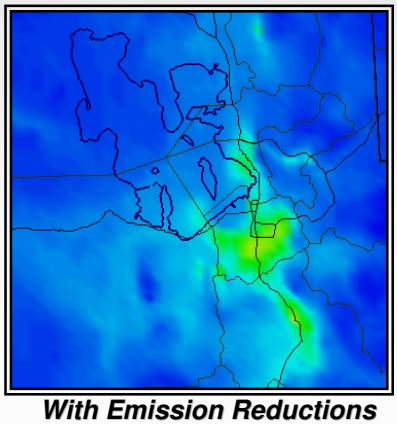
Image Credit: Time-Science.com

Can We Believe The Model?

- All models of complex systems have uncertainties, but they are the best tools available.
- The model is ***The Tool*** for determining how to clean Utah's air.



Modeled Air Pollution Now



With Emission Reductions

Utah Department of Environmental Quality

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Created December 2009

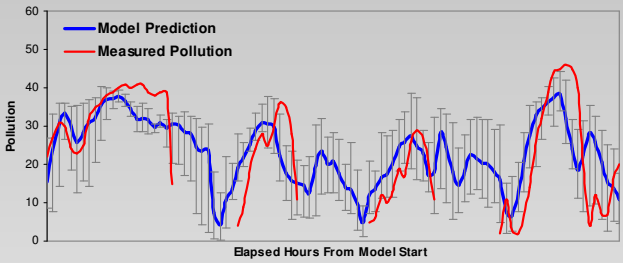
$PM_{2.5}$ SIP Modeling Process: Details

Step 1:

- Meteorological modeling is performed to provide input to the chemistry model.
- Meteorological modeling for the PM2.5[1] SIP[2] is provided by scientists with the Department of Army Dugway Proving Ground and the National Center for Atmospheric Research.
- Modeling area is divided into 4 kilometer by 4 kilometer "grid cells" in order to represent the variations in meteorology that occur from location to location.

Step 2:

- The meteorological-chemistry model[3] is run using current emissions inventory and tested against several recent historical pollution episodes[4].
- Results are compared to observed pollution concentrations to determine if the model is accurate.



Step 3:

- Develop future emissions inventory[5] based on projections of future year changes in population, industry, and automobile use.
- Use the meteorological-chemistry model with future year emission projections to predict future year pollution concentrations and compare concentrations to the Federal health standard.

Step 4:

- Develop emission strategies that the model demonstrates will reduce future year pollution concentrations below the Federal health standard.

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1. PM2.5 – Particulate matter that is less than 2.5 microns in diameter.
2. SIP – State Implementation Plan: Required by EPA to demonstrate the air pollution levels in the future will meet the National Ambient Air Quality Standard.
3. Meteorological-Chemistry Model – Computer model(s) that contain all relevant thermodynamic, fluid dynamics, and chemical equations and are used to predict meteorology and chemistry in continuous fields across the applied area. Models used: WRF, MM5, CMAQ.
4. Historical Pollution Episode – Times in the recent past with strong winter inversions and high build-up of pollution levels, i.e. February 14-18,2008.
5. Emissions Inventory Development - Methods used to calculate average pollution generated on an hourly basis by sources such as automobiles, large and small industries, and all other miscellaneous activities.

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